SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENGAJIAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PENILAIAN ALTERNATIF BERIKUTAN
PELAKSANAAN PERINTAH KAWALAN BERSYARAT

SESI JUN 2020

DJJ20063 : THERMODYNAMICS

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KAEDAH PENILAIAN : PEPERIKSAAN ONLINE

JENIS PENILAIAN : SOALAN ESEI BERSTRUKTUR (2 SOALAN)

TARIKH PENILAIAN : 29 JANUARI 2021

TEMPOH PENILAIAN : 1 JAM

LARANGAN TERHADAP PLAGIARISM (AKTA 174)
PELAJAR TIDAK BOLEH MEMPLAGIAT APA-APA IDEA, PENULISAN, DATA ATAU CIPTAAN ORANG LAIN. PLAGIAT ADALAH SALAH SATU PENYELEWENGAN AKADEMIK. SEKIRANYA PELAJAR DIBUKTIKAN MELAKUKAN PLAGIARISM, PENILAIAN BAGI KURSUS BERKENAAN AKAN DIMANSUHKAN DAN DIBERI GRED F DENGAN NILAI MATA 0.
(RUJUK BUKU ARAHAN-ARAHAN PEPERIKSAAN DAN KAEDAH PENILAIAN (Diploma) EDISI 6, JUN 2019, KLAUSA 17.3)

INSTRUCTION:
This section consists of **TWO (2)** structured essay questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **DUA (2)** soalan esei berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO1
C3

Steam enters a nozzle at 400°C and 800 kPa with a velocity of 10 m/s, and leaves the system at 300ºC and 200 kPa while losing heat at a rate of 25 kW to the surrounding. For an inlet area of 0.08m^2, calculate:

Stim memasuki muncung pada keadaan 400°C dan 800 kPa dengan kelajuan 10 m/s dan meninggalkan system tersebut pada 300ºC dan 200 kPa manakala kehilangan haba pada kadar 25 kW ke persekitaran. Luas kawasan aliran masuk ialah 0.08m^2, kirakan:-

i. Mass flow rate (kg/s)
Kadar alir jisim (kg/s)

ii. Outlet area (m^2)
Luas keluaran (m^2)

iii. Volume flow rate (m^3/s)
Isipadu alir jisim (m^3/s)

[25 marks]
[25 *markah*]

QUESTION 2
SOALAN 2

CLO1
C3

A steam power plant for Rankine cycle operates between a boiler and a condenser with the cycle efficiency of 35.9%. While the calculated feed pump and turbine work are 4 kJ/kg and 961.7 kJ/kg respectively. Calculate:

Sebuah penjana kuasa stim bekerja mengikut kitar Rankine antara dandang dan pemeluapan dengan kecekapan kitar ialah 35.9%, kerja pam suapan dan kerja turbin yang telah dikira ialah 4 kJ/kg dan 961.7 kJ/kg. Kirakan:

i. Heat pump supplied to the boiler.
Haba yang dibekalkan ke dandang.

ii. The work ratio
Nisbah kerja

iii. The specific steam consumption (s.s.c)
Pengunaan stim tentu (p.s.t)

[25 marks]
[25 *markah*]

SOALAN TAMAT

1. PROPERTIES OF PURE SUBSTANCE

Steam

$v = xv_g \qquad h = h_f + xh_{fg} \qquad u = u_f + x(u_g - u_f) \qquad s = s_f + xs_{fg}$

Ideal Gas

$PV = mRT \qquad R = \frac{R_o}{M} \qquad R = C_p - C_v \qquad \gamma = \frac{C_p}{C_v}$

2. FIRST LAW OF THERMODYNAMICS

$\Sigma Q = \Sigma W \qquad Q - W = U_2 - U_1$

Flow Process

$$\dot{m} = \rho CA(kg/s) = \frac{CA}{V} \qquad h = u + pv = Cp\,\Delta T$$

$$Q - W = \dot{m}\left[(h_2 - h_1) + \left(\frac{C_2^{\,2} - C_1^{\,2}}{2}\right) + (Z_2 - Z_1)g\right]$$

Non-Flow Process

1. **Isothermal Process** ($PV = C$)

$U_2 - U_1 = 0 \qquad Q = W$

$$W = P_1V_1 \ln\left(\frac{V_2}{V_1}\right) \quad @ \quad W = P_1V_1 \ln\left(\frac{P_1}{P_2}\right)$$

$$Q = P_1V_1 \ln\left(\frac{V_2}{V_1}\right) \quad @ \quad Q = P_1V_1 \ln\left(\frac{P_1}{P_2}\right)$$

2. **Adiabatic Process** ($PV^n = C$)

$$U_2 - U_1 = mC_v(T_2 - T_1) \qquad W = \frac{P_1V_1 - P_2V_2}{\gamma - 1} = \frac{mR(T_1 - T_2)}{\gamma - 1}$$

$$Q = 0 \qquad \frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} = \left(\frac{V_1}{V_2}\right)^{\gamma-1}$$

3. **Politropic Process ($PV^n = C$)**

$$U_2 - U_1 = mC_v(T_2 - T_1) \qquad W = \frac{P_1V_1 - P_2V_2}{n-1} = \frac{mR(T_1 - T_2)}{n-1}$$

$$Q = \frac{\gamma - n}{\gamma - 1} \times W \qquad \frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}} = \left(\frac{V_1}{V_2}\right)^{n-1}$$

4. **Isobaric Process**

$U_2 - U_1 = mC_v(T_2 - T_1)$
$W = P(V_2 - V_1) = mR(T_2 - T_1)$
$Q = (h_2 - h_1) = mC_p(T_2 - T_1)$

5. **Isometric Process**

$U_2 - U_1 = mC_v(T_2 - T_1)$
$W = 0$
$Q = U_2 - U_1 = mC_v(T_2 - T_1)$

3. SECOND LAW OF THERMODYNAMICS

Heat Engine

$$\eta_{th} = \frac{W_{net,out}}{Q_H} = 1 - \frac{Q_L}{Q_H}$$

Refrigerator

$$COP_{R,rev} = \frac{T_L}{T_H - T_L} = \frac{1}{T_H/T_L - 1}$$

Heat Pump

$$COP_{HP,rev} = \frac{T_H}{T_H - T_L} = \frac{1}{1 - T_L/T_H}$$

Power Cycle

$$\eta_{Rankine} = \frac{(h_1 - h_2) - (h_4 - h_3)}{(h_1 - h_4)}$$

$$\text{Work Ratio} = \frac{(h_1 - h_2) - (h_4 - h_3)}{(h_1 - h_2)}$$

$$s.s.c = \frac{3600}{(h_1 - h_2) - (h_4 - h_3)}$$